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A two-group path analysis of a food environment conceptual model by food security status: Home food environment variables were associated with HEI-2015 component scores for total vegetables among those with food security

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Abstract

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Author contributions: CCA conceived of and designed this secondary data analysis, performed analysis, lead data interpretation, and wrote the paper. RH helped guide the data analysis, contributed to interpretation of data, and edited the paper. MW contributed to interpretation of data and edited the paper. TJH contributed to interpretation of data and edited the paper. ABM contributed to interpretation of data and edited the paper. CM contributed to interpretation of data and edited the paper. MCK guided the analysis, contributed to interpretation of data, and edited the paper.

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Background. The Model of Community Nutrition Environments is a well-known conceptual model in public health nutrition, though few studies have tested the model as a valid representation of food environment-diet pathways. Further, no study has explored whether the model differs by food security status, despite documented disparities in food environments and diet for those experiencing food insecurity.

Objective. To test the Model of Community Nutrition Environments by food security status using multi-group path analysis.

Design. This secondary analysis of baseline data from a hybrid-effectiveness implementation trial, Healthy Homes/Healthy Families, which included a home environment survey and two unscheduled 24-hour dietary recalls, was merged with USDA's 2019 Food Access Research Atlas.

Participants/setting. Participants recruited through four United Way 2-1-1 agencies in Georgia, USA were eligible if they were 18-70 years old, spoke English, and self-reported a BMI of ≥ 20 kg/m². Baseline data collection occurred from October 2020-December 2022 (n=510 participants).

Main outcome measures. Main outcomes included Healthy Eating Index (HEI)-2015 component scores for total fruits and total vegetables.

Analyses. Multi-group path analysis compared unstandardized effects of pathways in the Model of Community Nutrition Environments for those who were food secure and food insecure.

Results. The two-group model had good global model fit (RMSEA=0.000, CFI=1.000, TLI=1.000, SRMR=0.047). Home availability ($b=0.08$, $SE=0.04$, $p=0.029$) and accessibility ($b=0.68$, $SE=0.27$, $p=0.012$) of fruits and vegetables were positively associated with HEI-2015 scores for total vegetables among those with food security. No significant associations were found with either outcome among those with food insecurity. The food secure model explained more variance in the outcomes than the food insecure model (food secure: $R^2_{\text{total fruits}}=0.20$, $R^2_{\text{total vegetables}}=0.36$; food insecure: $R^2_{\text{total fruits}}=0.10$, $R^2_{\text{total vegetables}}=0.06$).

Conclusions. Additional mechanisms need to be added to the Model of Community Nutrition Environments to better explain food environment-diet pathways for those experiencing food insecurity.

Keywords

food insecurity; healthy eating index; food access; low-income populations; nutrition environment

Introduction

An estimated 18 million U.S. households experienced food insecurity in 2023.¹ Food insecurity affects individuals' interactions with food environments, shopping habits, and, ultimately, dietary behaviors. Adults with food insecurity have reported lower perceived access (e.g., ease in getting fresh produce) and objective access (e.g., availability of grocery stores) to healthy foods in their neighborhoods²⁻⁴ and have less healthy home food environments (e.g., lower availabilities of fruits and certain vegetables) than those who are food secure.⁵⁻⁷ Adults with food insecurity also have different shopping behaviors, including less frequent shopping trips per month, shopping more often at convenience stores,

and purchasing fewer fruits and vegetables (FV), and have less healthy diets than food secure adults, including lower FV intakes.^{2–4,6,8}

While the literature is replete with differences in food environments, shopping behaviors, and diet by food security status, public health nutrition still lacks a clear understanding of the pathways by which food environments affect dietary behaviors, as much of this research is pervaded by inconsistent and null findings.^{9–12} One reason for such equivocal results may have to do with the conceptual models available in the field. While many studies invoke social-ecological theories to describe how food environments impact dietary behaviors, these broad multi-level theories often result in very different conceptual models across studies.^{13–17}

One well-known conceptual model is the Model of Community Nutrition Environments (MCNE), initially developed in 2005¹⁸ and expanded in 2015 to serve as the conceptual model for the Perceived Nutrition Environment Measures Survey (NEMS-P).¹⁴ The model posits that dietary behaviors are influenced by the community food environment (i.e., neighborhood-level, e.g., distance traveled to grocery shopping locations) and consumer food environment (i.e., features within food retail venues, e.g., pricing), which are correlated.¹⁴ These food environments also indirectly impact dietary behaviors through the home food environment and shopping behaviors, which are also correlated.¹⁴ Finally, food insecurity is modeled as a moderator of food environment-diet pathways in the MCNE, as are background characteristics (e.g., sociodemographics, self-reported health status).¹⁴

Though many studies have incorporated MCNE constructs into research,^{2,19–21} few have tested the validity of the MCNE as a conceptual model of food environments on dietary quality outcomes. One study tested the MCNE via exploratory and confirmatory factor analysis (EFA, CFA) with the EFA resulting in four factors which mapped onto only three constructs in the MCNE (i.e., the consumer, community, and home food environments).²² A second study analyzed the criterion validity of the NEMS-P, though neither shopping behaviors nor food insecurity were included.¹⁹ Other studies have tested individual pathways depicted in the model, most commonly the direct pathways from the community and consumer food environments to diet, without the inclusion of the home food environment, shopping behaviors, or food insecurity.^{9,12} Results of these studies are mixed, underscoring the need to systematically investigate additional pathways and to include food insecurity in multi-level models of food environments and diet, as these models likely operate differently for those who are food insecure and for those who are food secure. The goal of this study was to test the MCNE as a theory of pathways from food environments to FV dietary quality using path analysis and to compare the model by food security status among a sample of primarily low-income women from a healthy eating intervention.

Methods

Data

This secondary analysis used baseline data from a telephone-based hybrid-effectiveness implementation trial of Healthy Homes/Healthy Families (HH/HF) ([NCT01326897](#)).²³ United Way 2–1–1 staff from four 2–1–1 agencies in Georgia, USA recruited 2–1–1

callers for this healthy eating and weight-gain prevention intervention. 2–1–1 is a helpline whose staff provide information and referrals to those in need of services including food assistance²⁴ and whose clients are disproportionately low-income, unemployed, and women.²⁵ Interested 2–1–1 clients between the ages of 18–70 who spoke English and had a self-reported body mass index (BMI) of $\geq 20\text{kg/m}^2$ were eligible for the study. Of the 1,410 2–1–1 clients referred to the study by 2–1–1 agencies, 784 were eligible, and 630 were enrolled; 512 completed baseline data collection, and 510 were included in the analytic sample.²³ HH/HF was approved by Emory University’s Institutional Review Board, and participants’ verbal informed consent was obtained prior to data collection.

During baseline data collection (October 2020 through December 2022), a home environment survey followed by two unscheduled 24-hour interviewer-administered dietary recalls were collected via telephone and processed using the U.S. National Cancer Institute’s ASA24 online diet assessment program.²⁶ The home environment survey included questions regarding the home food environment, shopping behaviors, perceived barriers to accessing food, food insecurity, and socio-demographics,^{27,28} and the 24-hour recalls were used to generate Healthy Eating Index (HEI) 2015 scores.²⁹ The average time from data collection for the home environment survey to completion of the first dietary recall was 21 days ($SD=23.74$). For an objectively-measured food access variable, participant addresses were geolocated using ArcGIS and joined with census tract data from the U.S. Census Bureau and USDA’s 2019 Food Access Research Atlas.³⁰ The MCNE was adapted for this study using variables available from HH/HF and the Food Access Research Atlas to focus specifically on FV.

Measures

Observed Nutrition Environment. Census tract food access is a binary variable from USDA’s Food Access Research Atlas that categorizes a census tract as low-access if at least 33% of the census tract population live more than 1 mile for urban tracts or more than 10 miles for rural tracts from the nearest supermarket or grocery store (1=low-access, 0=not low-access).³⁰

Perceived Nutrition Environment. The perceived nutrition environment was measured with a perceived barriers scale (range of 1–5, higher scores indicate greater barriers), which consisted of three items informed by previous research that asked participants to report how often (never, rarely, occasionally, often, very often) access to fresh FV, cost of fresh FV, and limited access to transportation were barriers to healthy eating.³¹

Home Food Environment. Two variables were used in the model to describe the home food environment. First, FV availability consisted of a 30-item inventory where participants were asked if 13 fruits and 17 vegetables, fresh or frozen, were in the home within the last week. This inventory was adapted from other validated measures^{32,33} to be regionally-appropriate and has been used in previous HH/HF trials.^{27,28,34} Second, FV accessibility was measured by asking participants two previously-validated questions on whether they kept FV in a place where they could be easily seen and reached.³² This was categorized into

a single variable indicating whether participants kept *both* FV where they could be easily seen and reached.

Shopping Behaviors. FV shopping frequencies were assessed with two questions that asked participants how often they or someone in their household bought FV in the past month, with response options of less than once per week, once per week, or more than once per week.^{28,34}

Fruit & Vegetable Intake. The 2015 Healthy Eating Index (HEI-2015) was calculated for each participant from their two 24-hour dietary recalls using the mean ratio method.³⁵ The validated HEI produces an overall diet quality score and 13 component scores;³⁶ the outcomes of interest for this analysis were HEI-2015 Total Fruits and HEI-2015 Total Vegetables component scores, both of which range from 1–5.²⁹

Food Security Status. Food security was measured with the validated 2-item screener,³⁷ where participants who responded sometimes or often to both of the following scenarios were categorized as food insecure: “In the past twelve months, I was worried whether my food would run out before I got money to buy more” and “In the past twelve months, the food that I bought just didn’t last and I didn’t have money to get more.”

Socio-demographics. Age, sex (1=female, 2=male), race/ethnicity (1=non-Hispanic Black, 2=non-Hispanic White, 3=Hispanic, 4=Asian/Pacific Islander, 5=non-Hispanic American Indian/Alaska Native, 6=more than one racial/ethnic identity selected), education (1=high school diploma/GED or less, 2=some college or technical school, 3=college degree or more), employment status (1=working full-time, 2=working part-time, 3=not employed/homemaker/student/ on disability), annual household income (1= $\leq$ \$25,000, 2=\$25,001–\$50,000, 3=\$50,001–\$75,000, 4= $\geq$ \$75,000), BMI ($<25\text{kg/m}^2$, $\geq 25\text{--}30\text{kg/m}^2$, $\geq 30\text{kg/m}^2$), and general health (1=excellent, 2=great, 3=good, 4=fair, 5=poor)³⁸ were all self-reported and used to describe participants’ background characteristics. These variables were included as confounders in the path models. Rural-urban continuum codes (RUCC), ranging from 1–9, were used as a descriptive variable to further conceptualize the sample but were not included in analyses.³⁹

Analysis

Data were first described in SAS 9.4⁴⁰ using means and standard deviations for continuous variables or frequencies and percentages for categorical variables. Data were also assessed for missingness, multivariate normality, multivariate outliers, and the variance-covariance matrix was examined. In MPlus,⁴¹ multiple imputation was used to create ten imputed datasets as missing data was approximately 10% among demographic variables.⁴² Path analysis was used to test the MCNE pathways from various food environments to FV dietary quality.

The first model was conducted with all participants (N=510) and was re-specified using theory-driven data-informed decisions⁴³ until acceptable model fit was achieved (data not shown; root mean square error of approximation (RMSEA)=0.042, comparative fit index

(CFI)=0.994, Tucker-Lewis index (TLI)=0.731, standardized root mean square residual (SRMR)=0.015).⁴⁴ Subsequent models were based on the full-participant model.

Food insecurity was then explored as a moderator per the MCNE.¹⁴ First, bivariate analyses were conducted in SAS to analyze the extent to which the predictors and outcomes differed by food security status. Results (Supplemental Table 1) pointed to this sample of food secure and food insecure participants as heterogeneous on a range of food environment characteristics. A two-group path analysis (food secure vs. food insecure), which allows for separate error distributions for each group,⁴⁵ was then conducted to investigate whether the MCNE operated differently by food security status. Error covariances were also analyzed to understand the extent of unmodeled associations in the two-group model. Significance was established at $p<0.05$.

All models used theta parameterization and WLSMV estimator. Unstandardized parameter estimates, which were averaged over the ten imputed datasets, were reported for the two-group model. Standardized estimates were then used to describe the variances explained in the outcomes by the two-group model.

Results

Sample characteristics are shown in Table 2. Participants (n=510) primarily self-reported being women (92%) and non-Hispanic Black (82%), with incomes $\leq$ \$25,000 (65%) and an average age of 43.4 years. Most (63%) had a BMI ≥ 30 kg/m², and many reported fair (34%) or poor (10.2%) health. Nearly three-quarters of participants (74%) reported experiencing food insecurity in the previous 12 months. Participants represented 379 census tracts, 62% of which were low-food access census tracts. Nearly all (98%) participants lived in urban census tracts (i.e., identified by a RUCC of 1–3), with 69% living in a metropolitan county with a population of 1 million or more (RUCC=1). Participants averaged 2.5 (SD=1.07) on the perceived barriers scale, from a range of 1 (few barriers) to 5 (greater barriers). Within the home food environment, participants on average reported having about half of the 30 FV available (14.6, SD=5.12) and 85% reported keeping both FV where they could easily be seen and reached. About half of participants reported shopping for fruits (47%) and vegetables (50%) more than once per week. Participants scored an average of 2.5 (SD=2.06) and 3.3 (SD=1.55) out of 5 on HEI-2015 component scores for total fruits and total vegetables, respectively.

The two-group model had good global fit (RMSEA=0.000, CFI=1.000, TLI=1.000, SRMR=0.047) (Figure 1). Unstandardized estimates for all pathways tested in the two-group model are in Supplemental Table 3. The model for food secure households (n=133) had explained variances of 20% and 36%, respectively, for HEI-2015 scores for total fruits and total vegetables. Greater FV availability in the home was associated with a 0.08-point higher score for total vegetables, and keeping FV in easily accessible locations in the home was associated with a 0.68-point higher score for total vegetables among the food secure group. Also in the food secure group, higher scores on the perceived barriers scale (i.e., greater perceived barriers to healthy food access) were associated with lower FV accessibility in the home ($b=-0.45$), and living in a low-food access census tract was associated with

less frequent vegetable shopping ($b=-0.38$). Few error covariances were significant within the food secure model: FV home availability with fruit shopping frequency and vegetable shopping frequency with fruit shopping frequency.

The model for food insecure households ($n=377$) explained only 10% of the variance in scores for total fruits and 6% of the variance in total vegetables (Figure 1). Unlike in the food secure group, there were no significant associations with HEI-2015 scores for total fruits and total vegetables among those with food insecurity. Among those who experienced food insecurity, those who lived in a low-food access tract were more likely to grocery shop for fruits more frequently ($b=0.17$). There were many more significant error covariances in the food insecure model compared to the food secure model. FV home availability had significant error covariances with FV home accessibility and both FV shopping frequencies. FV home accessibility also had significant error covariances with both FV shopping frequencies. The error term for fruit shopping frequency significantly covaried with the error term for vegetable shopping frequency, and the error terms for HEI-2015 total fruits and total vegetables also significantly covaried.

Discussion

Results of the two-group path analysis of the MCNE pathways of food environments on FV dietary quality in this sample of primarily low-income women had meaningful differences by food security status, both in the variances explained and significant associations with HEI-2015 scores for total fruits and total vegetables. The model for food insecure participants explained only a small amount of variation in HEI-2015 scores for total fruits and total vegetables (10% and 6%, respectively), whereas among food secure participants, the model explained far more variation in the outcomes (20% for total fruits and 36% for total vegetables). Additionally, the only significant associations with the outcomes were among food secure participants, where FV accessibility in the home, and to a smaller extent, FV availability in the home, were positively related to HEI-2015 scores for total vegetables.

Only two other studies have tested the MCNE,^{19,22} and results from the present study regarding the significant associations between the home food environment and the HEI-2015 component score for total vegetables for those with food security mirror those studies with some notable differences. Alber and colleagues tested the MCNE among over 200 participants in Philadelphia to assess the criterion validity of the NEMS-P and found that perceived quality of FV in the neighborhood, as well as the availability and accessibility of FV in the home, were positively associated with combined FV intake.¹⁹ However, it is uncertain if they would have found similar effects of the home food environment on diet had they examined FV separately, as in the current study. Additionally, Karpyn and colleagues tested the MCNE using EFA and CFA among a sample of nearly 800 adults in two urban, low-income cities in the Northeast US. The EFA revealed three factors related to the MCNE, i.e., store quality, perceived neighborhood food availability, and household food challenges, which they mapped onto the consumer, community, and home nutrition environments from the MCNE, respectively, all of which had significant direct effects on HEI-2010 scores for total vegetables in the CFA.²² Yet, as both home food availability and grocery spending behaviors were included in the household food challenges factor, it is

unclear if the association with vegetable scores would hold had the factor only contained home food inventory items.

Studies of similar conceptual models to the MCNE have also found significant associations between home food environments and dietary behaviors, including between FV availability in the home and FV intake¹⁶ and between availability of high-fat foods in the home and dietary fat intake.¹⁵ However, few studies have explored how associations between the home food environment and diet differ by food security status.^{6,46–48} Results from two intervention studies revealed that healthier home food environments were associated with better dietary outcomes (e.g., FV intake, diet quality) among food secure households, whereas food insecure households either experienced smaller or non-significant changes in dietary outcomes,^{46,47} echoing findings from this study. These results suggest that the financial and structural challenges faced by food insecure families are significant barriers that may impede dietary improvements despite successful changes to the home food environment.

Though global fit statistics (i.e., RMSEA, CFI, TLI, and SRMR) indicated that the two-group model had good global model fit, models with good global fit can still have large disturbances as indicated by small R^2 s.⁴⁹ Therefore, the differences in explained variance, direct effects, and error covariances by food security status may suggest that the model needs to be modified to better explain such pathways, particularly for food insecure populations. Specifically, the low explanatory power of the model for food insecure participants may indicate that the MCNE is underspecified among those experiencing food insecurity. This is further supported by the fact that nearly all error covariances included in the model with food insecure participants were significant, pointing to possible unmodeled shared causal mechanisms among these variables, while far fewer error covariances were significant in the food secure model. In other words, the MCNE, as it currently stands, is much better at explaining how food environments impact FV intakes for those with food security than those who are food insecure. Incorporating additional variables and pathways into the MCNE would likely improve the MCNE as a conceptual model that explains how food environments impact dietary behaviors for those with food insecurity. Structural drivers of food insecurity, such as redlining, are notably absent from the MCNE.⁵⁰ Considering the history of structural racism in the South that aimed to keep minority populations in socially marginalized positions, it may be particularly important to include such social and structural determinants in future studies of food environment impacts on diet among adults in similar geographic contexts.^{51,52}

Though the two-group model had seemingly low explanatory power for HEI-2015 scores for total fruits and total vegetables among both food secure and food insecure groups, studies of other conceptual models of the food environment have found similarly low explained variance in dietary outcomes. For example, Liese and colleagues found only 3% of variation in FV intake was explained by their model among primarily rural residents of South Carolina, and Freedman et al. found their model explained 15% to 28% of the variation in HEI-2010 total scores among residents in two urban food deserts.^{13,17} Findings from the current study extend that range, but the wide range of variances may point to nuances in food environment pathways according to study population (e.g., urban versus

rural) and dietary outcomes (e.g., overall diet quality versus diet components like FV). Additional testing with more constructs in the MCNE is required to better understand how food environments impact FV dietary quality.

This study has several important strengths. First, given the lack of well-tested conceptual models in public health nutrition, this study adds to the handful of studies to empirically test the MCNE, which will hopefully promote further exploration of this model. Second, this is the only study to our knowledge to test the MCNE while prioritizing food insecurity as a key factor in pathways between food environments and diet. Third, the sample of this study, i.e., mostly low-income Black women, represent a population disproportionately affected by food insecurity¹ who would benefit greatly by a better understanding among researchers of the ways in which food environments impact diet for those struggling with food insecurity. Lastly, the large geographic span of participants in this study, covering 379 census tracts, is a unique addition as most studies are confined to one or two municipalities.^{13,17,19,22}

Nonetheless, there are limitations. Power analysis for the original hybrid-effectiveness implementation trial was aimed at showing intervention effectiveness, so the viability of the present study was only assessed as a secondary analysis. The cross-sectional design for baseline data collection did not allow for causal assumptions to be made about relationships in this analysis; additional research with data from randomized controlled trials could support these findings with causal claims. Sample sizes, particularly for the food secure group, were relatively small, though this study can aid in determining an appropriate sample size for future studies conducting similar analyses. Results may not generalize, since participant demographics represented a very specific population of primarily low-income women in Georgia. Additionally, HEI scores indicate adherence to the Dietary Guidelines for Americans; represent diet quality via densities, not absolute intakes; and do not provide information on energy balance.²⁹ Future studies could examine FV intakes and/or diet quality considering total energy intake. Baseline data collection for the intervention occurred throughout the COVID-19 pandemic and the subsequent period of unusually high inflation and repeal of COVID-era safety nets,^{53,54} though results can still provide insights into food environment-diet pathways during this challenging time. Though the MCNE is a fairly comprehensive model of food environments, not all variables in the original model were incorporated in the present study, including the portion of the model devoted to restaurants, which may have contributed to the low explained variances in the dietary outcomes. Finally, the MCNE specifies food insecurity as a moderator of food environment-diet pathways, which does not allow for food environment variables to influence food security status; future research could benefit from exploring food insecurity as a mediator of pathways in the MCNE.

Conclusions

This research furthers the understanding of food environment-diet relationships as specified in the MCNE and the ways such relationships differ by food security status among a relatively homogenous sample of low-income adults. In this two-group path analysis of the MCNE, home availability and accessibility of FV had a positive effect on the HEI-2015 component score for total vegetables only among those with food security. The lack of

direct effects and the low variances explained for HEI-2015 component scores among food insecure participants warrants the investigation of different mechanisms that link food environments to diet for food insecure households. A better understanding of these distinct diet-related pathways is needed to guide policies and interventions aimed at creating more equitable food environments and reducing diet-related health disparities, especially for those experiencing food insecurity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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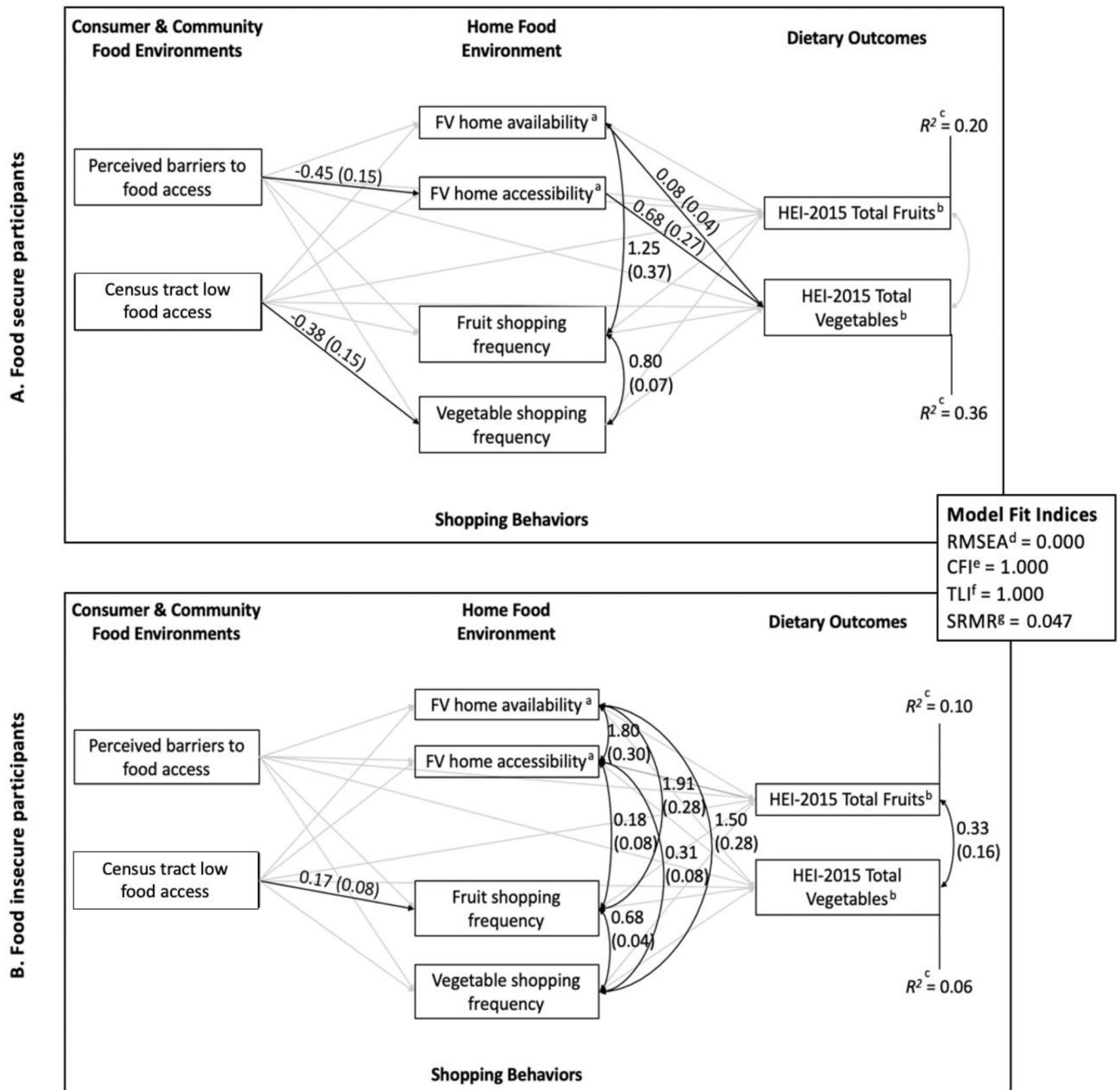
Research Snapshot

Research Question:

Do food environment-diet pathways in the Model of Community Nutrition Environments differ by food security status among a sample of primarily low-income women?

Key Findings:

This secondary path analysis of the Model of Community Nutrition Environments using baseline data from of a hybrid-effectiveness implementation trial found that the availability and accessibility of fruits and vegetables in the home were positively associated with HEI-2015 scores for total vegetables among those with food security. No significant associations were found with HEI-2015 scores for total fruits or total vegetables among those with food insecurity.

**Figure 1.**

Significant unstandardized estimates and error covariances with standard errors of a two-group path analysis of the Model of Community Nutrition Environments comparing the model for (A) food secure (n=133) and (B) food insecure (n=377) participants. Grey lines depict nonsignificant pathways (available in Supplemental Table 3).

^a FV=fruits and vegetables.

^b HEI=Healthy Eating Index.

^c R²=variance explained.

^d RMSEA=root mean square error of approximation

^e CFI=comparative fit index

^f TLI=Tucker-Lewis index

^g SRMR=standardized root mean square residual

Table 2

Sample characteristics of 510 ^a participants from baseline data collection of the Healthy Homes/Healthy Families hybrid-effectiveness implementation trial

	N (%) or mean (SD)
Sociodemographics	
RUCC,^b n, %	
1–3, metro counties	498 (97.6)
4–9, non-metro counties	12 (2.3)
Age (years), mean, SD	43.4 (11.93)
Sex, n, % female	467 (91.6)
Race/ethnicity, n, %	
Black, not of Hispanic origin	416 (81.6)
White, not of Hispanic origin	52 (10.2)
Hispanic	10 (2.0)
Asian	2 (0.4)
American Indian/Alaska Native	1 (0.2)
More than one race	22 (4.3)
Unknown or not reported	7 (1.4)
Education, n, %	
High school diploma or less	196 (38.4)
Some college or technical school	194 (38.0)
College degree or more	120 (23.5)
Employment Status, n, %	
Working full-time	139 (28.0)
Working, part-time	87 (17.5)
Retired	30 (6.1)
Not employed/homemaker/student/on disability	240 (48.4)
Annual household income, n, %	
≤\$25,000	317 (65.1)
\$25,001 – \$50,000	127 (26.1)
\$50,001 – \$75,000	23 (4.7)
>\$75,000	20 (4.1)
Body mass index (kg/m²), n, %	
<25 kg/m ²	73 (14.3)
≥25 – <30 kg/m ²	114 (22.4)
≥30 kg/m ²	322 (63.3)
General health, n, %	
Excellent	36 (7.1)
Very good	81 (15.9)

	N (%) or mean (SD)
Good	166 (32.6)
Fair	174 (34.2)
Poor	52 (10.2)
Moderator Variable	
Food security, n, %	
Food secure	133 (26.1)
Food insecure	377 (73.9)
Observed Nutrition Environment	
Census tract food access, n, %	
Low access	316 (62.0)
Not low access	194 (38.0)
Perceived Nutrition Environment	
Perceived barriers scale,^c mean, SD	2.5 (1.07)
Home Food Environment	
Fruit and vegetable accessibility, n, %	
Easily accessible	432 (84.7)
Not easily accessible	78 (15.3)
Fruit and vegetable availability (of 30), mean, SD	14.6 (5.12)
Shopping Behaviors	
Fruit shopping frequency, n, %	
Less than once per week	103 (20.2)
Once per week	166 (32.6)
More than once per week	240 (47.2)
Vegetable shopping frequency, n, %	
Less than once per week	88 (17.3)
Once per week	165 (32.4)
More than once per week	256 (50.3)
Eating Behaviors	
HEI-2015^dtotal score^e	51.9 (12.64)
HEI-2015^dcomponent score – total fruits^c	2.5 (2.06)
HEI-2015^dcomponent score – total vegetables^c	3.3 (1.55)

^aValues may not add to 510 due to missing data.

^bRUCC=Rural-Urban Continuum Codes: 1, metro county with population of ≥1 million; 2, metro county with population of 250,000 – <1 million; 3, metro county with population <250,000; 4, non-metro county with urban population ≥20,000, adjacent to metro area; 5, non-metro county with urban population ≥20,000, not adjacent to metro area; 6, non-metro county with urban population 5,000 – <20,000, adjacent to metro area; 7, non-metro county with urban population 5,000 – <20,000, not adjacent to metro area; 8, non-metro county with urban population <5,000, adjacent to metro area; 9, non-metro county with urban population <5,000, not adjacent to metro area.

^cRange 1–5.

^dHEI=Healthy Eating Index.

^eRange 0–100.

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